CLAIMS

IN THE CLAIMS:

1. A method of making a composite three-dimensional object comprising:

(a) forming a continuous filament comprising a longitudinally extending continuous fiber and a material-laden composition comprising a thermoplastic polymer and at least about 40 volume % of a ceramic or metallic particulate, wherein the filament includes a green matrix material from the material-laden composition, and wherein the green matrix material completely surrounds the fiber;

(b) passing the filament to a movable assembly for guiding placement of the filament onto an associated working surface;

(c) depositing the filament onto the working surface to form a first layer having a predetermined filament orientation;

(d) depositing the filament onto the working surface to form a second layer on top of the first layer;

(e) heating the deposited filament, a portion of the layer adjacent the deposited filament and a portion of layer below the deposited filament to a predetermined temperature effective for softening the green matrix material to provide a heated portion;

(f) compressing the heated portion with a force effective for consolidating and bonding the green matrix material; and

(g) solidifying the heated portion to provide a composite object of a predetermined geometry.

2. The method of claim 1 further comprising preheating the filament as it is deposited onto the work surface to a temperature effective for adhering the filament to previously

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deposited filament.

3. The method of claim 1 wherein the filament includes one or more interface layers between the matrix material and the fiber for enhancing non-brittle failure characteristics of the composite and oxidation protection.

4. The method of claim 3 wherein the one or more interface layer include materials selected from the group consisting of graphite, boron nitride, silicon carbide, boron carbide, silicon nitride, sodium silicate, boric oxide and blends thereof.

5. The method of claim 1 wherein the filament includes a plurality of discrete fibers.

6. The method of claim 1 further comprising immersing the filament in a composition effective for increasing flexibility of the filament prior to depositing the filament onto the working surface.

7. The method of claim 1 further comprising:

(a) creating a drawing of the desired composite three-dimensional object utilizing a computer-aided design process, wherein the process generates a drawing including a plurality of segments; and

(b) generating input signals based on the drawing for directing the movable assembly in the depositing the filament onto the working surface, wherein the movable assembly is guided in response to the signals.

8. The method of claim 1 further comprising blending a thermoplastic binder with the material-laden composition and heating the composite object to remove thermoplastic binder from the composite object and consolidating the composite object to provide a fully dense fiber reinforced composite object.

9. A composite object formed by the method of claim 1.

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10. A composite object formed by the method of claim 7.

11. A three-dimensional fiber reinforced composite object formed by the steps comprising:

(a) forming a continuous filament comprising a longitudinally extending continuous fiber and a material-laden composition comprising a thermoplastic polymer, at least about 40 volume % of a ceramic or metallic particulate, and a thermoplastic binder, wherein the filament includes a green matrix material from the material-laden composition, and wherein the green matrix material completely surrounds the fiber;

(b) passing the filament to a movable assembly for guiding placement of the filament onto an associated working surface;

(c) creating a drawing of the composite three-dimensional object utilizing a computer-aided design process, wherein the process generates a drawing including a plurality of segments;

(d) generating input signals based on the drawing for directing the movable assembly to deposit the filament onto the working surface in a predetermined arrangement, wherein the movable assembly is guided in response to the signals;

(e) depositing the filament onto the working surface to form a first layer having a predetermined filament orientation;

(f) depositing the filament onto the working surface to form a second layer on top of the first layer;

(g) heating the deposited filament, a portion of the layer adjacent the deposited filament and a portion of layer below the deposited filament to a predetermined temperature effective for softening the green matrix material to provide a heated portion;

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(h) compressing the heated portion with a force effective for consolidating and bonding the green matrix material;

(i) solidifying the heated portion to provide a composite object of a predetermined geometry;

(j) heating the composite object to remove thermoplastic binder from the composite object; and

(k) consolidating the composite object to provide a fully dense fiber reinforced composite object.

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